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NATIONAL DAM SAFETY PROGRAM, LAKE TISHOMINGO DAM (MO 30039) JEF--ETC(U)
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SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

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19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

LAKE TISHOMINGO DAM
JEFFERSON COUNTY, MISSOURI

MISSOURI INVENTORY NO. 30039

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY: ST. LOUIS DISTRICT CORPS OF ENGINEERS
FOR: GOVERNOR OF MISSOURI

JANUARY 1978

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Lake Tishomingo Dam
State Located	Missouri
County Located	Jefferson County
Stream	Unnamed tributary to Belew Creek
Date of Inspection	15 December 1977

Lake Tishomingo Dam was inspected by an interdisciplinary team of engineers from the St. Louis District, U.S. Army Corps of Engineers. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam is classified as an intermediate size dam with a high downstream hazard potential. Failure would threaten the life and property of approximately 34 families downstream of the dam and cause appreciable damage to highway BB, approximately one mile downstream of the dam.

Our inspection and evaluation indicates that the spillway does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The spillway will pass a 1 percent chance flood (100-year flood) without overtopping, which is a flood that has a 1 percent chance of being exceeded in any given year.

Other deficiencies visually observed by the inspection team were sloughing, seepage, burrows, and a very thick cover of brush and small trees on the downstream embankment slope. Another deficiency found was the lack of seepage and stability analysis records.

We recommend that the owner take action to correct or control the deficiencies described. A detailed report discussing each of these deficiencies was prepared and submitted to the lake owners and to the Governor of Missouri.

Ken Alexander

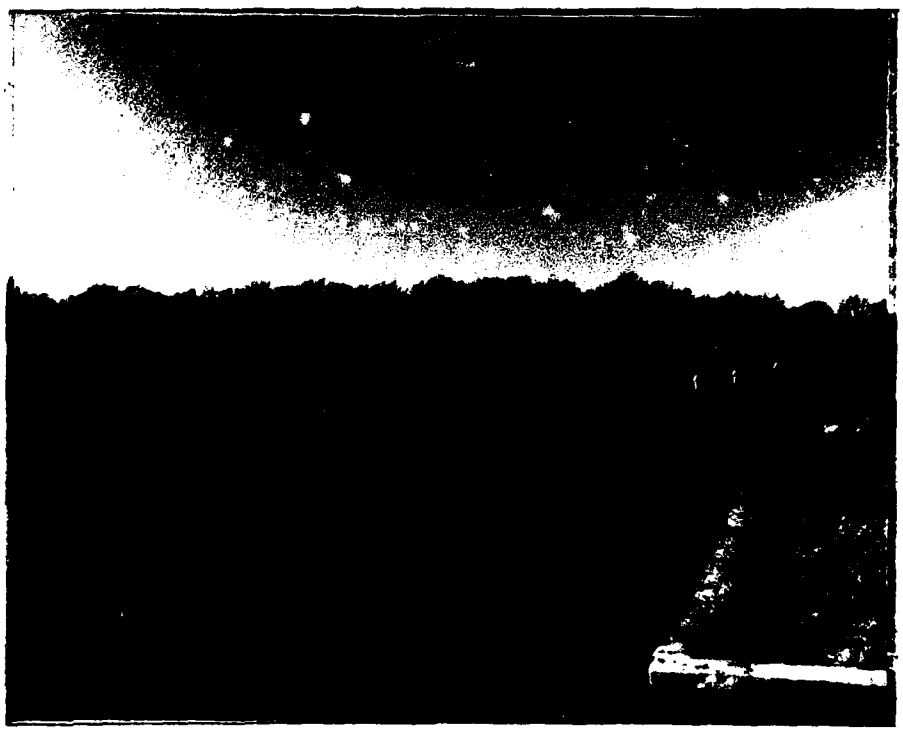
KEN ALEXANDER
Soils Engineer
St. Louis District
Corps of Engineers

Chien Hsieh

CHIEN (NANCY) HSIEH
Hydraulic Engineer
St. Louis District
Corps of Engineers

SUBMITTED BY: _____ 17 APRIL 78
Chief, Engineering Division — Date

APPROVED BY: Leon E. Mellenbruch 18 April 1978
Colonel, CE, District Engineer — Date



OVERVIEW OF LAKE AND DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
LAKE TISHOMINGO DAM - ID NO. 30039

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SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of the Lake Tishomingo Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams." These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth structure built in a narrow valley in the northeastern part of the Ozarks. Topography adjacent to the valley is rolling to steep. Soils on the steeper slopes are formed in thin loess deposits over weathered material from cherty limestone. Topography in the vicinity of the dam is shown on Plate 1.

(2) A spillway was cut in the Jefferson City dolomite on the left abutment (west end of dam). A plug approximately 20 feet long by 4 feet wide by 5 feet deep was recently excavated from the left side of the spillway to lower the lake for maintenance in the upper end of the lake. This excavation was replaced with earth. A small concrete cap was placed on a remaining portion of the rock spillway to prevent erosion (See Plate 3).

(3) Pertinent physical data are given in paragraph 1.3 below.

b. Location. The dam is located in the central portion of Jefferson County, Missouri, as shown on Plate 1. The lake formed by the dam is shown on the Missouri-Jefferson County Belew Creek quadrangle sheet in the NE 1/4 of the SW 1/4 of Section 5, T41N, R4E.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, this dam and impoundment is in the intermediate size category.

d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph c above. Based on referenced guidelines, this dam is in the High Hazard Classification.

e. Ownership. This dam is owned by the Lake Tishomingo Home Owners Association, which includes approximately 193 home owners.

f. Purpose of Dam. The dam forms a 120-acre recreational lake.

g. Design and Construction History. The inspection team was unable to find any design data on this dam. It was reported that construction on the dam began in 1948 and water impoundment commenced in 1950. The dam was constructed by a construction firm from Bloomsdale, Missouri. Several unsuccessful attempts were made to contact the original owner, in search of design and/or construction data.

h. Normal Operating Procedure. Normal rainfall, runoff, transpiration, and evaporation all combine to maintain a relatively stable water surface elevation. The maximum water depth ever experienced at the spillway was reported to be one foot.

1.3 PERTINENT DATA

a. Drainage Area - 1,900 acres.

b. Discharge at Damsite.

(1) All discharge at the damsite is through an uncontrolled spillway.

(2) Estimated experienced maximum flood at damsite - 150 c.f.s.

(3) Estimated ungated spillway capacity at maximum pool elevation - 2,200 c.f.s.

c. Elevation (Feet Above M.S.L.).

(1) Top of dam - 538± (see Plate 3).

(2) Spillway crest - 532.1.

(3) Streambed at centerline of dam - 470 (est.).

(4) Maximum tailwater - unknown.

d. Reservoir. Length of maximum pool - 6,500 feet ±.

e. Storage (Acre-feet). Top of dam - 3,128 (from 1974 inventory).

f. Reservoir Surface (Acres).

(1) Top of dam - 120.

(2) Spillway crest - 115 (est.).

g. Dam.

(1) Type - earth embankment.

(2) Length - 870 feet.

(3) Height - 68 feet maximum (from 1974 inventory).

(4) Top width - 50 feet (see note below).

(5) Side Slopes -

(a) Downstream - 1v on 2.2h (determined with Brunton compass as average).

(b) Upstream - 1v on 1.8h (from 1974 inventory).

(6) Zoning - unknown.

(7) Impervious core - unknown.

(8) Cutoff - unknown.

(9) Grout curtain - unknown.

NOTE: It was reported that the width of the crest has been increased by placing rock, concrete, gravel, etc., at the top of the upstream slope (see Photos 3 & 4).

h. Diversion and Regulating Tunnel. None.

i. Spillway.

(1) Type - concrete and rock (see paragraph 3.1c).

(2) Length of weir - 50 feet (see paragraph 3.1c).

(3) Crest elevation - 532.1 feet m.s.l.

j. Regulating Outlets. None.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data were found to be readily available.

2.2 CONSTRUCTION

The dam was constructed in 1948 and 1949 by a contractor from Bloomsdale, Missouri. No additional construction data are available.

2.3 OPERATION

The maximum loading on the dam reported by an owner was a storm which produced about 1 foot of water passing over the uncontrolled spillway. Lake levels remain stable during average precipitation of 38 inches per year.

Local residents reported that a leak developed near the right abutment about 12 years ago. Asphalt was injected into the dam and stopped the leak. The methods used, amount of grout injected, and severity of the leak are all unknown. Three asphalt pads were observed on the crest of the dam, which is said to be the location of the grouting.

2.4 EVALUATION

a. Availability. The only engineering data readily available were a report on a downstream slide prepared by the Missouri Geological Survey, dated 15 October 1973, and a report on the feasibility of removing silt from the upper reaches of the lake prepared by the "Metropolitan Engineering Company," which is a consulting firm located in Arnold, Missouri.

b. Adequacy. The engineering data available were inadequate to make a detailed assessment of the design, construction, and operation. The owner should have an engineer experienced in the design of dams to perform detailed seepage and stability analysis.

c. Validity. The above reports were primarily for maintenance and operation and not to give engineering data on design and construction. Therefore, no valid engineering data on design or construction were found.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of Lake Tishomingo dam was made on 15 December 1977. Personnel making the inspection were employees of the St. Louis District, Corps of Engineers, and included a hydraulic engineer, soils engineer, structural engineer, mechanical engineer, and a materials engineer. Specific observations are discussed below.

b. Dam. The inspection team observed the following items at the dam. The downstream slope of the dam was covered with brush and small trees which made it difficult to determine the slope stability, settlement, and/or seepage. However, several areas of small slides, horizontal and vertical holes, and one area of seepage near the right abutment were observed. These holes all appear to be caused by small burrowing animals (see Photos 3, 4, 5, and 6). Pin boils, fine sand, and stringy asphalt were observed in the vicinity of the seep. The repair of the slide referred to in paragraph 2.4 was observed (see Photo 4). Several areas of ponded water were observed near the downstream toe (see Photo 7). It was reported that the downstream area near the toe of the dam is dry during dry seasons. Therefore, this ponded water appears to be caused from a combination of precipitation run-off from adjacent bluffs and poor drainage conditions; not seepage from the upstream reservoir. The steep upstream slope shown on Photo 3 was reported to have resulted from the dumping of rock, broken concrete, and gravel at the upstream crest. This slope does not represent the as-built condition and will not affect the overall upstream slope stability. No transverse or longitudinal cracks were observed in the dam embankment.

c. Appurtenant Structures. Thirty feet of the 50-foot rock spillway adjacent to the embankment near the left abutment was covered with a 24-inch by 8-inch concrete cap. A 20-foot long by 4-foot wide by 5-foot deep slot was cut in the remaining 20-foot rock spillway adjacent to the abutment. This slot was filled with clay. The uncontrolled spillway is the only structure existing at this dam to control pool levels (see Photo 8). A depth of 1 + inches of water was flowing over the spillway on the day of the inspection.

d. Reservoir Area. No wave wash, excessive erosion, or slides were observed along the shore of the reservoir. Recently approximately 100,000 cubic yards of silt were removed from the upper end of the reservoir.

e. Downstream Channel. Spillway discharge flows over a series of rock falls to reach the original channel (see Photo 9). The rock in the falls is a moderately competent argillaceous dolomite and is in good condition.

3.2 EVALUATION

None of the conditions observed are significant enough to indicate a need for immediate remedial action or a serious potential of failure. Visually observed small slides, horizontal and vertical holes, seepage, and uncontrolled vegetation on the downstream slope are deficiencies which, left uncontrolled or uncorrected, could lead to a serious potential of failure.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no controlled outlet works for this dam; therefore, no regulating procedures exist. The pool is controlled by rainfall, runoff, evaporation, and capacity of the uncontrolled spillway.

4.2 MAINTENANCE OF DAM

Based on the amount of brush and size of trees on the downstream slope, it has been several years since the vegetation on this slope has been cut. A slide on the downstream of the dam has recently been repaired.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities exist at this dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

The inspection team is not aware of any existing warning system for this dam.

4.5 EVALUATION

If the uncontrolled vegetation on the downstream slope is allowed to continue, a serious potential of failure may develop.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. No design data available.

b. Experience Data. The drainage area and lake surface area are developed from USGS Belew Creek Mo. Quadrangle. The spillway and dam layout are from surveys made during the inspection.

c. Visual Observations.

(1) Concrete weir spillway and the falls at exit channel are in good condition.

(2) No drawdown facilities are available to evacuate the pool.

(3) The spillway and exit channel are located at the farthermost left abutment. Spillway releases will not endanger the integrity of the dam.

d. Overtopping Potential. The spillway is too small to pass the minimum required flood of the probable maximum without overtopping. The probable maximum flood is defined as the flood discharge that may be expected from the most severe combination of critical meterorologic and hydrologic conditions that are reasonably possible in the region. The existing spillway will pass a 100-year frequency flood without overtopping. According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, the 100-year frequency flood is only adequate for a low hazard dam of intermediate size.

Failure of upstream water impoundments shown on the 1974 revised USGS map would not have a significant impact on the hydrologic or hydraulic analysis.

The effect from rupture of the dam could extend approximately 7-1/2 miles downstream of the dam. There are 34 inhabited homes downstream of the dam which could be severely damaged and lives of the inhabitants could be lost should failure of the dam occur.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations which adversely affect the structural stability of this dam are discussed in Section 3, paragraph 3.1b.

b. Design and Construction Data. No design or construction data relating to the structural stability of the dam were found.

c. Operating Records. No appurtenant structures requiring operation exist at this dam. In 1977, the pool was lowered approximately five feet by cutting a notch in the spillway. The purpose of lowering the pool was to remove silt from the upper end of the lake. After silt was removed, the notch was backfilled with clay. These operations did not adversely affect the structural stability of the dam.

d. Post Construction Changes. No post construction changes, other than those referenced to in paragraph a above, exist which will affect the structural stability of the dam.

e. Seismic Stability. Considering the seismic zone (2) in which this dam is located, an earthquake of this magnitude is not expected to cause a structural failure of this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. Several items were noted during the visual inspection by the inspection team which should be corrected or controlled. These items, which exist on the downstream slope, are seepage, trees and brush, small horizontal and vertical holes, ponding at toe, and small slides. The extent of some of these items can be better assessed after the trees and brush have been removed. The stability of and seepage conditions on the cleared downstream slope should be investigated and analyses made by an engineer experienced in design of dams. These analyses should be utilized to detail the corrective actions called for in paragraph 7.2. Maximum design flood will overtop the dam; however, the spillway is adequate to pass a flood expected to be exceeded once in 100 years without overtopping.

b. Adequacy of Information. Due to the lack of engineering design and construction data, the conclusions in this report were based on performance history and external visual conditions. The inspection team considers that these data are sufficient to support the conclusions herein.

c. Urgency. The remedial measures recommended in paragraph 7.2 should be accomplished in the near future. If the safety deficiencies listed in paragraph a are not corrected in the near future, they will continue to deteriorate and lead to a serious potential of failure.

d. Necessity for Phase II. Based on the results of the Phase I inspection, no Phase II inspection is recommended.

e. Seismic Stability. This dam is located in Seismic Zone 2. An earthquake of this magnitude is not expected to be hazardous to this dam.

7.2 REMEDIAL MEASURES

a. Alternatives. Spillway size and/or height of dam should be increased to pass the probable maximum flood without overtopping the dam.

b. Perform seepage and stability analyses to assess the safety concerns raised by the sloughs and seeps present on the downstream slope. Use the results of these analyses to design appropriate corrective measures.

c. O&M Maintenance and Procedures. The following O&M maintenance and procedures are recommended:

(1) Remove trees and vegetation from the downstream slope. Care should be taken during removal not to destroy the existing condition of the downstream slope.

(2) Check the downstream slope periodically for seepage and stability problems. If seepage flows are observed or sloughing noted, the dam should be inspected and situation evaluated by an engineer experienced in design and construction of dams.

(3) Ponding near the downstream toe caused from runoff from the slopes adjacent to the valley should be eliminated. Ponding at the downstream toe reduces stability of the dam and prevents early detection of seepage.

(4) A detailed inspection of the dam should be made at least every 5 years by an engineer experienced in design and construction of dams. This is especially appropriate for this dam since it has had a history of past slides and seeps. More frequent inspections may be required if slides, seeps, or other items of distress are observed.

APPENDIX A

HYDROLOGIC COMPUTATIONS

HYDROLOGIC COMPUTATIONS

1. Triangle unit hydrograph and HEC-1 are used to develop the inflow hydrographs (see Plate A1) and hydrologic inputs are as follows:

a. Twenty-four hour, 100-year rainfall of St. Louis, or probable maximum precipitation from hydrometeorological report No. 33.

b. Drainage area = 3 square miles.

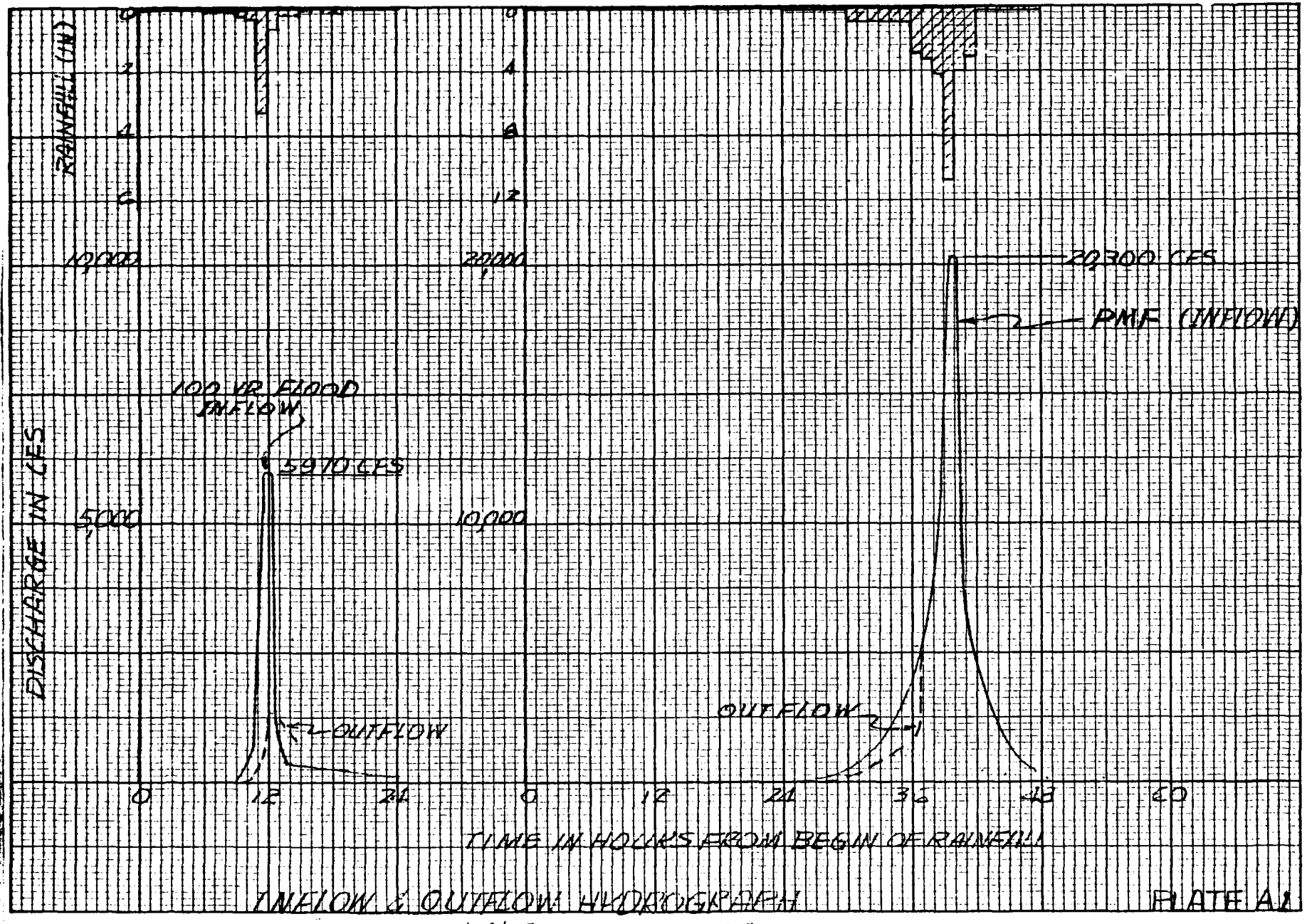
c. Travel time of runoff = 60 minutes.

d. Initial loss = 1 inch.

e. Average loss rate = 0.08 inch per hour.

2. Spillway release rates are based on the broad-crested weir equation: $Q = CLH^{1.5}$ (C=3.0, L=50 feet), where H is the head on weir.

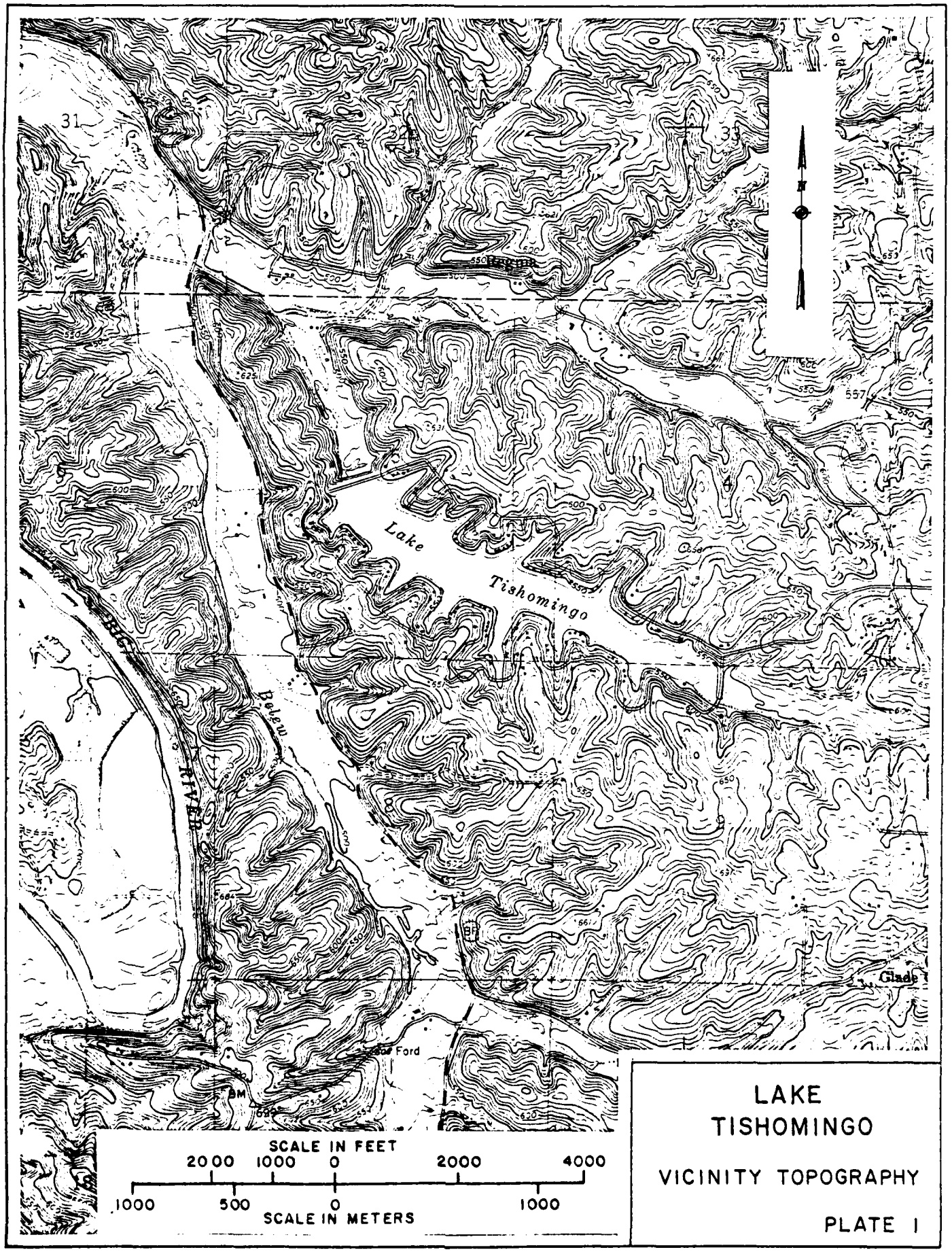
3. Floods are routed through the spillway to determine the capability of the spillway. Outflow hydrographs are shown on Plate A1.



INFLOW & OUTFLOW HYDROGRAPH

PLATE A1

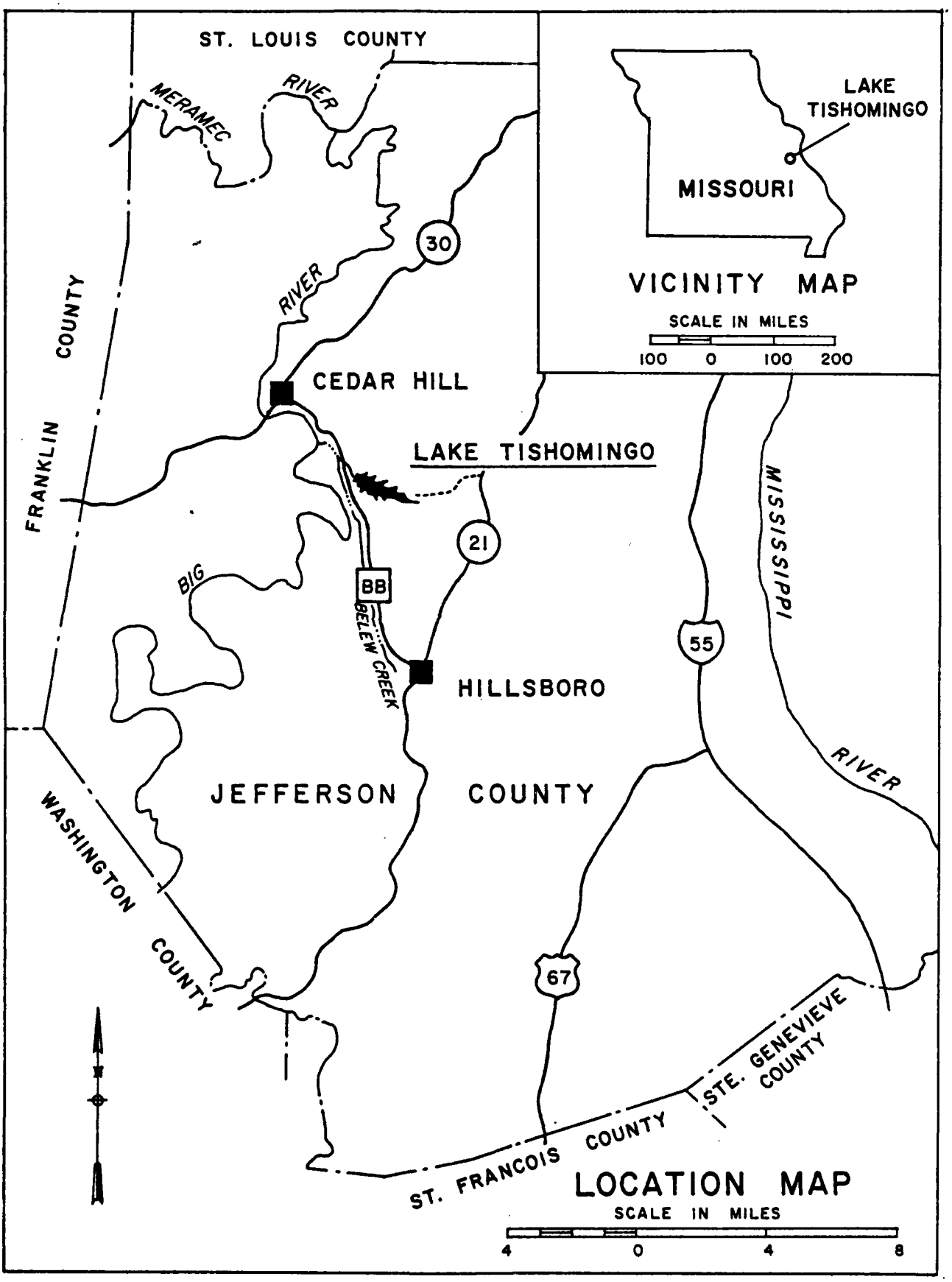
LAKE TISHOMINGO



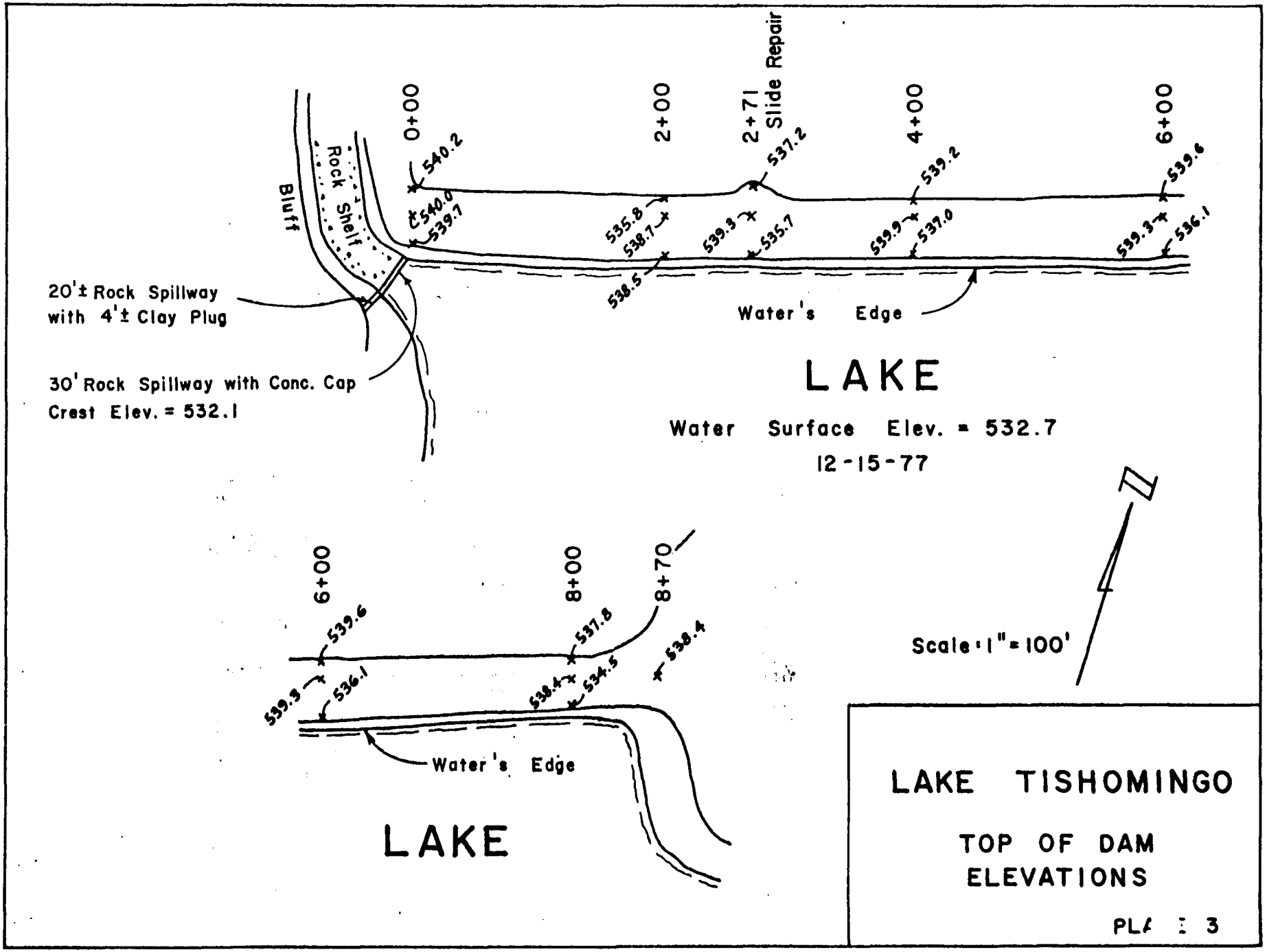
LAKE TISHOMINGO

VICINITY TOPOGRAPHY

PLATE 1


ST. LOUIS COUNTY
MERAMEC
RIVER
30
RIVER
FRANKLIN COUNTY
CEDAR HILL
LAKE TISHOMINGO
21
BIG
BB
BELEW CREEK
HILLSBORO
JEFFERSON COUNTY
WASHINGTON COUNTY
MISSISSIPPI
55
RIVER
67
STE. GENEVIEVE COUNTY
ST. FRANCOIS COUNTY
LOCATION MAP
SCALE IN MILES
4 0 4 8
LAKE TISHOMINGO
MISSOURI
VICINITY MAP
SCALE IN MILES
100 0 100 200

PL. TE 2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2+00
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Slide Repair
4+00
6+00
Bluff
Rock Shelf
540.2
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539.7
535.8
538.7
538.5
539.3
535.7
537.2
539.9
537.0
539.2
539.3
536.1
539.6
20'± Rock Spillway
with 4'± Clay Plug
30' Rock Spillway with Conc. Cap
Crest Elev. = 532.1
Water's Edge
LAKE
Water Surface Elev. = 532.7
12-15-77
6+00
8+00
8+70
539.6
539.3
536.1
537.8
538.4
534.5
538.4
Water's Edge
LAKE
Scale: 1" = 100'
LAKE TISHOMINGO
TOP OF DAM
ELEVATIONS
PLATE 3

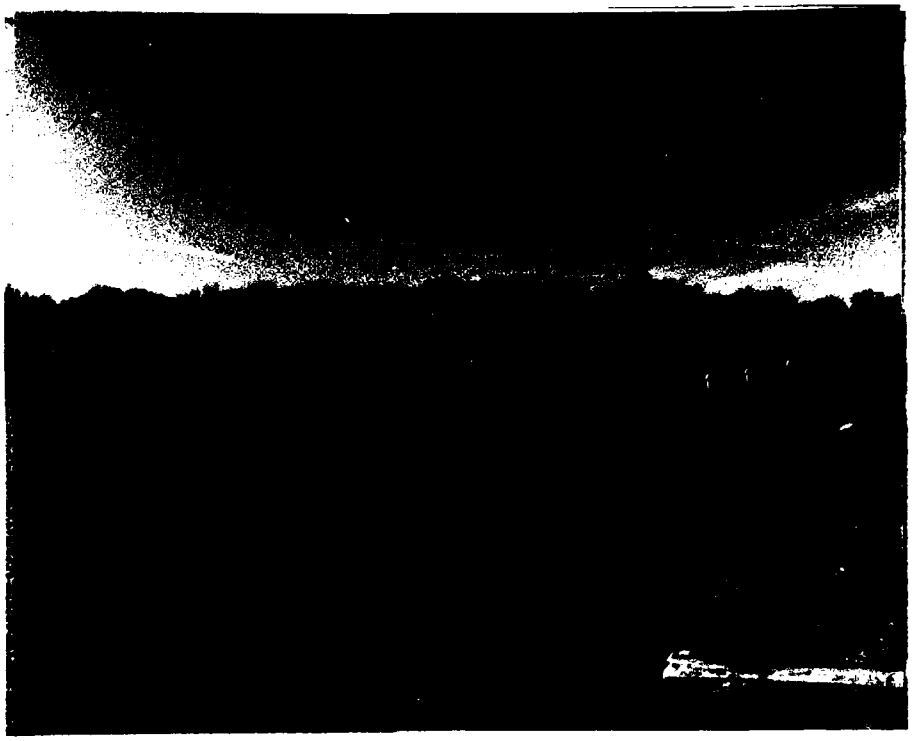

PHOTO 1: Overview of Lake and Dam

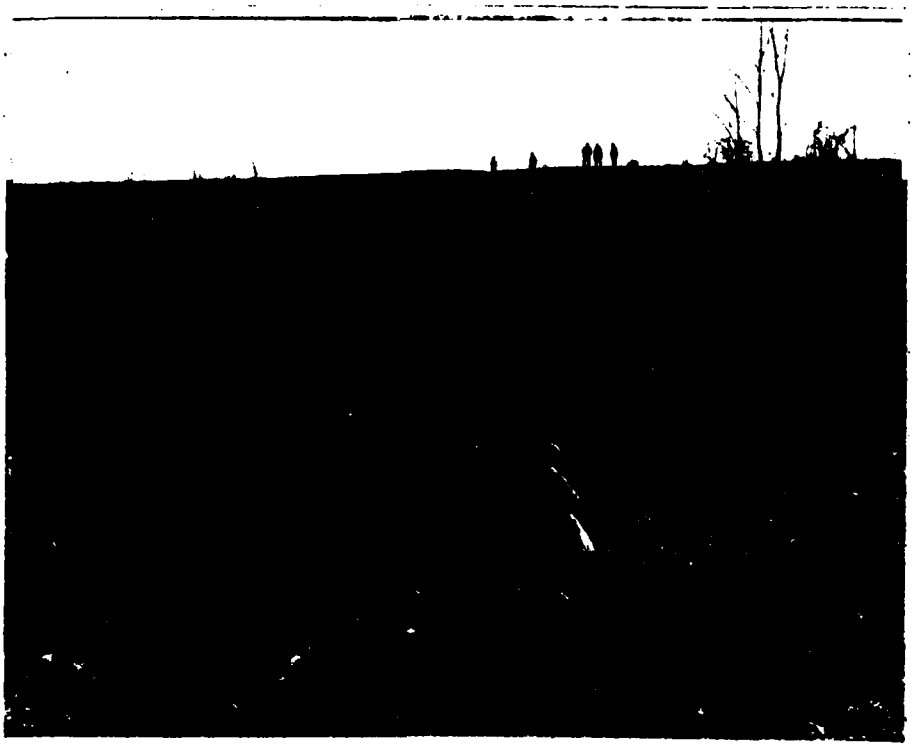

PHOTO 2: Recently Repaired Downstream Slide

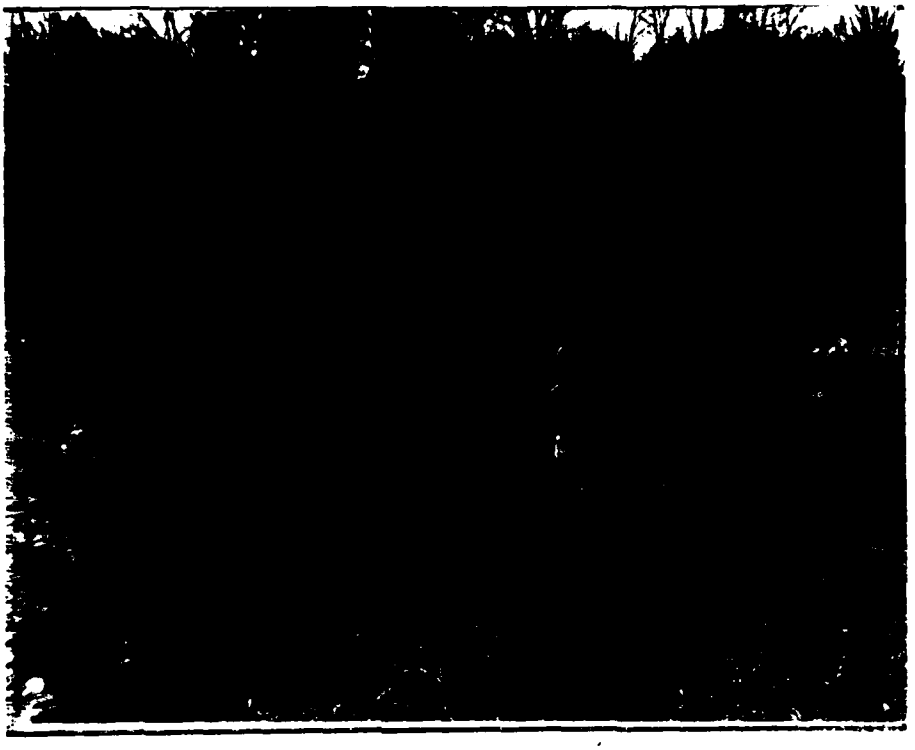

PHOTO 3: Steep Upstream Slope

PHOTO 4: Crest of Dam

PHOTO 5: Small Hole in Downstream Embankment

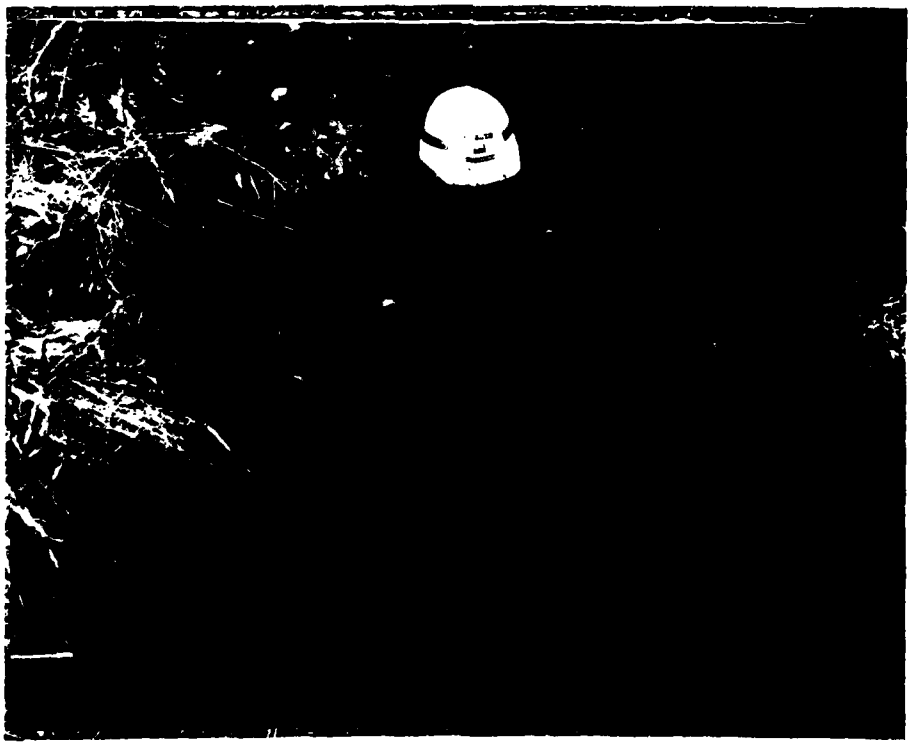

PHOTO 6: Seepage From Hole In Downstream Embankment

PHOTO 7: Ponding Near Downstream Toe

PHOTO 8: Weir Spillway

PHOTO 9: Spillway Exit Falls